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TUBERCULOSIS—THE HOME HOSPITAL EXPERIMENT.¹

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In 1912 in New York City there were 9,981 deaths from tuberculosis. During that same year there were reported to the Department of Health 22,752 new cases of this disease. In that year in New York City there were carried over from the preceding year 32,635 cases. The disease presents, evidently, an imperative problem.

In dark, dirty, unventilated, overcrowded rooms exists many a family, usually with numerous children, of which family one or both parents have consumption. Frequently several of the children also are tuberculous and all are inevitably exposed to the disease. Not infrequently the consumptive mother is nursing an ill-fated babe. In the sputum-poisoned, germ-charged atmosphere tuberculosis develops, unrecognized and unchecked. The infected, unsegregated in this close-knit family life and opposed to separation from their loved ones, constitute a deadly menace to their family and neighbors.

The home itself is in disorder, the family in partial or utter dependency. Formerly self-respecting and independent, they have now lost the hope and often the capacity for self-support. Standards of living and of morals have either deteriorated or utterly vanished. This description is literally true of hundreds of families among the tenement poor in New York City.

To relieve these conditions various agencies are at work. Among these, and attaining a valuable measure of success, are the *dispensary* with its clinic and visiting nurses; the *preventorium* for the treatment of children over 4 years of age believed to be predisposed to tuberculosis; the *sanatorium* for the cure of incipient patients; and the *hospital* for the segregation and care of advanced cases. These agencies, excepting in part the dispensary, treat the patient apart from his home, are concerned with the individual rather than with the family as a unit, and deal almost entirely with the physical rather than with the social and economic needs.

¹ Read before the Southern Conference on Tuberculosis, Atlanta, Ga., Nov. 30, 1914.

But tuberculosis is not merely a human disease. It is a social disorder, and the real problem is not alone the patient, but the family and the conditions under which it lives. As these were basic in causing the disease, so their correction is vital to the permanent cure of the patient and to the eventual welfare of his family. To treat the social ills, therefore, is quite as important as to cure the disease, for without social rehabilitation the disease is most liable to recur in the patient and to continue in his family.

Based upon such convictions as these the Home Hospital experiment was established by our association on March 19, 1912, for the combined treatment of tuberculosis and poverty among the tenement poor of New York City. More specifically, the object sought is to demonstrate that if sanitary housing with ample sunshine and fresh air, adequate income, including good and abundant nourishment, freedom from undue work and worry, reasonable segregation, skillful medical care, and constant nursing supervision be provided, it is possible:

1. To prevent the spread of tuberculosis from the sick to the well members of the family and particularly to protect the children from infection.

2. To cure any of the family who are in the early stages of the disease.

3. To secure improved health and larger earning capacity to patients whose cases are moderately advanced; and

4. To complete, at least in instances, the rehabilitation of the family, physically, economically, and socially.

The Home Hospital, ideally located at Seventy-eighth Street and John Jay Park, occupies two entire sections of the East River homes of which one section was opened March 18, 1912, when the experiment was established. The second section was leased last year and was occupied on November 24. Two open staircases lead to the 48 apartments, consisting of from two to four rooms each, including one or more bed chambers with open-air sleeping balconies. From a sanitary standpoint these apartments far excel the most exclusive apartments in New York City. No expense has been spared to provide a maximum amount of sunlight and ventilation for each room. Even the windows, extending from ceiling to floor, are arranged in three sashes, so that when open, two-thirds of the space is unobstructed. On the roof is a spacious solarium, with hedges of privet and geraniums. A part of this solarium is reserved for the patients. Here in reclining chairs they take the cure. Another part of the roof is a children's playground, where there is no premium on fresh air and sunshine. There they play and make merry, remote from the danger of infection. Still another part of the roof is occupied by a fresh-air school.

In selecting families to participate in this experiment preference has been given, first, to families in which both poverty and tuberculosis are more or less incipient; second, to families believed to possess sufficient intelligence to cooperate in the experiment; third, to families in which dependency is due to tuberculosis of the wage earner; and, fourth, to families in which tuberculosis of the mother renders it inadvisable to keep the home together under ordinary circumstances; in general, to poor families made or kept dependent by tuberculosis and in which the disease is not more than moderately advanced. Most of the families were already under the relief care of the association, and selection was made without regard to nationality or religion.

It is to be noted that treatment is provided in this way for children too young to be admitted to preventoria, for patients unwilling or unable to leave their families, and especially for the largest and, because of its irresponsibility, most dangerous class of sufferers, namely, the more or less chronic second stage and able-to-be-about cases almost entirely unprovided for by other institutions.

The actual selection of families is made in the following manner: A relief visitor of the association visits and carefully investigates the home conditions, and if she decides that the family is suitable, all members report to the Home Hospital clinic for examination. If the case is one which gives fair promise of being cured in a reasonable length of time, or even of such improvement as to restore partial earning capacity of the patient, the family is admitted. It will be readily seen by examining the cases in the appendix of the Home Hospital report that the selection of patients has not been confined to favorable early stage cases.

As its name implies, one of the purposes of the hospital is to preserve the home. Therefore, so far as possible, each family is permitted and helped to live a normal home life. The medical régime adopted is that of the best sanatoria and hospitals, including regular physical examinations, weekly sputum tests, adequate segregation of the more advanced cases, open windows and outdoor life upon balcony, the roof, or in the park near by, absolute rest for those who need it, and a graduated amount of exercise for appropriate cases, and constant medical oversight, nursing care, and home inspection.

The patients, encouraged to work on tasks proportioned to their increasing strength, are thus prepared for a return to normal activity and to complete resumption of family responsibility. When the family is about to be discharged, the securing of employment and a sanitary home completes the care provided.

To each family, on admission, is given careful and oft-repeated instruction in precautions necessary to prevent the spread of consumption to the well members. Individual toilet articles are given to each member of the family, and all necessary furniture, clothing,

and household supplies are provided. Countless minor details in respect to prophylaxis and sanitation of the home are carefully explained, and particular emphasis is laid on the value of fresh air and personal hygiene as preventives not only of tuberculosis but also of other diseases.

To care for the patients and to supervise and educate both the sick and the well members of the families, the association has a staff of 14 persons at the hospital. This consists of a superintendent, a medical director, an attending physician, two nurses, a nurses' helper, a mothers' helper, two clerks, a cook, and four cleaners.

All positive and suspected cases are examined every six weeks, healthy children every three months, and healthy adults every six months. The results of each examination are recorded on a separate chart. After each examination the patient is advised as to his condition, and is given instructions accordingly. If the patient has active symptoms, with cough, sputum, elevation of pulse and temperature, etc., he is ordered to remain in bed. He sleeps out of doors on the balcony, is carefully fed, and isolated as far as possible from the well members of the family. The children are not allowed in the patient's bedchamber or in close contact with him. The family is encouraged to spend the day on the roof, and to return to the apartments only to eat and sleep.

With improvement, the patient spends the day on the roof, reclining in a steamer chair. Extra nourishment is given him at 10 a. m., at 3 p. m., and just before retiring. Arrested cases are at first allowed to do light work for a few hours each day, care being taken that the temperature, pulse, weight, and physical signs and symptoms remain satisfactory.

A daily morning and afternoon temperature and pulse record is kept of all positive and suspected cases. Each week sputum examinations are made and weights are recorded. Each patient is provided with a notebook, in which answers to the following questions are entered daily:

How many hours sleep?

How many sections window open at night?

Head or feet to open window?

Amount cough, sweat, or expectoration (during both day and night)?

Hour of arising?

Morning tub?

Cold water to chest?

Breakfast menu?

Morning temperature?

Hour started for roof?

Dinner menu?

Hour returning from the roof?

Nourishment at 10 a. m.?

Temperature at 3 p. m.?

Supper menu?
Nourishment at 9 p. m.?
Hour of retiring?
Amount exercise or work during day?
Amount of sleep during day?
Chills, day or night?
Total hours spent in the open during day?
Total amount of milk and eggs during day?
Condition of bowels?
Gain or loss in weight each weighing day?
Amount of earnings, if any?
General remarks.

The records, besides being extremely interesting, keep always before the patient the essentials of the cure, and there has gradually developed a friendly rivalry among the patients, for each desires to excel in improvement. The hygienic-dietetic form of treatment has been followed. No special drugs have been employed. Tuberculin was administered in suitable cases during the second year of the experiment.

The attending physician visits and holds clinics at the hospital on Monday, Wednesday, Friday, and Saturday of each week. One evening each month he meets all the patients in class conference. These gatherings are informal, the patients being encouraged to discuss their condition and ask questions.

At the same time that the patients are being treated for tuberculosis the other members of the family are treated for any physical defects they may have. They are also taught how to live properly and how to preserve their health. To the mothers instruction is given regularly in cooking, sewing, nursing, care, and feeding of infants, personal cleanliness, hygiene, and sanitation. The children attend regularly a fresh-air school on the roof.

What have been the medical results of this experiment? During the first year 11 families were discharged, 6 having been rehabilitated physically, socially, and economically. The other 5 were dismissed for intemperance or refusal to cooperate. During the past year 14 families were discharged, 11 having been restored to health and earning capacity. Three refused to follow advice and were dismissed.

Since the beginning of the experiment, of a total of 36 positive patients and 10 suspects discharged during the two years only 2 cases have relapsed. It is most gratifying to visit the homes of these discharged families and to find sanitary and prophylactic measures observed. The children continue to gain in health and strength and the mothers frequently express their gratitude for all the good and happiness the Home Hospital has brought them.

In no instance has a well member of a family developed symptoms of tuberculosis, either while at the Home Hospital or since discharge.

This would tend to show that, although the adult patient remains at home, there is little danger of infecting others if prophylactic measures are maintained. It also indicates that the degree of tuberculosis in any community, like the incidence of typhoid fever, is a fair index of that community's hygienic status. Teach people to live properly and tuberculosis will rapidly wane.

Inasmuch as some of the adult patients are of a somewhat different type from those treated at sanatoria, it has seemed wise to classify them under the following groups:

Group A: Cases with definite physical signs of pulmonary tuberculosis and with tubercle bacilli in their sputa.

Group B: Cases with definite physical signs of pulmonary tuberculosis, but without tubercle bacilli in their sputa.

Group C: Inactive cases with evidence of slight healed lesions.

Group D: Cases which have been in the hospital insufficient time to have their disease arrested.

During the two years the hospital has cared for 62 families, including 315 individuals, classified diagnostically as follows:

Positive cases, 136; suspects, 71; nonpatients, 108.

The results for the adult groups for those cases with positive signs are as indicated by the following figures:

Apparently cured, 21; arrested, 16; improved, 8; not improved, 4; died, 1; total cases, 50.

This record, I believe, compares favorably with that of tuberculosis sanatoria, especially in the second-stage cases. There were 31 such cases, 13 of which were apparently cured. Of the 15 first-stage cases, 8 were cured.

Not a single patient who has followed advice has failed to improve.

In no instance has a well member of a family developed symptoms of tuberculosis while a resident at the Home Hospital. This would tend to show that with proper supervision of patients under hygienic surroundings, there is little danger of infecting others.

The greatest good obtained is not the mere restoration of the adult member of the family to health and earning capacity. He has the disease and perchance may some day succumb to it, for it is well recognized that tuberculosis is a chronic relapsing disease. It is the children who are of especial concern.

To-day's anemic child of the tenement is the coughing, germ-spreading adult of to-morrow. Left unrescued in its inimical environment it may never reach maturity. The children from 3 to 14 years of age have, therefore, claimed our special attention. Upon admission over 75 per cent were underdeveloped, pale misfits—excellent candidates for the so-called latent or pretubercular class. During their residence at the hospital they are practically isolated

from the infected adults and are given every hygienic advantage. They are well fed, receiving extra nourishment twice daily. They spend the entire day in the fresh air and at night sleep in rooms with the windows wide open. The children of school age attend the open-air school on an adjoining roof.

Realizing the great difficulty of diagnosing tuberculosis in children, and also the difference of opinions of pediatricians as to what syndrome constitutes active pulmonary tuberculosis, we have adopted the expedient of classifying our suspected children under two groups:

Group A: Those under 12 years of age who present the following symptoms:

1. Underweight for age.
2. Constant or frequent cough.
3. Occasional or constant rise in temperature of undiscoverable origin.
4. Râles (near one or both nipples, constant or inconstant interscapular dullness).
5. Positive von Pirquet reaction (under 4 years).

Group B: Those who are delicate and present some of the above symptoms and physical signs.

According to this classification we find 60 patients and 67 suspects among the 189 infants and children under care. In other words, 31.7 per cent of the children of tuberculous parentage probably already have thoracic tuberculosis, and 34.4 per cent more are excellent candidates for the disease. It is probable that a similar appalling percentage holds true in thousands of tenement children.

The results obtained with the children have been so gratifying that we believe the experiment would be well worth while even had the adult cases shown no improvement.

A study of the weight charts of the positive and suspect children is most interesting. When admitted most of the children are underweight and underdeveloped. At the end of six months of treatment at the Home Hospital their gain in weight, according to their respective ages, not only equals that of the normal healthy children in the hospital but in most cases is considerably in excess.

Interesting also is a comparative study of the gain in weight, according to age, of healthy normal outside children and of those at the Home Hospital for a period of six months. It was noted that the underdeveloped children made a gain not only comparable to but considerably in excess of that of healthy children, so that at the end of six months many reached a weight normal for their age.

The improvement of the infants (1 to 3 years) quite rivaled that of the children. The babies are placed in cribs on the roof, where during the summer there is always a cool breeze. Careful formula feeding, good nursing, "patience and hope" have had their reward. Each week has brought results.

The average gain in weight for the infant patients has been 3.78 pounds in 180 days' average residence, and the suspect infants have gained an average of 3.4 pounds in a similar time.

One marasmic infant weighed 6 pounds and 15 ounces at 9 months. Her normal weight at this age should have been 17.5 pounds. The baby had been at a good city hospital and the mother was told it could not live. Shortly after admission to the Home Hospital the infant gained 1 pound and 7 ounces in one week and has continued to gain at the rate of $9\frac{3}{4}$ ounces a week.

The excellent results obtained with the infants and children indicate, we believe, the real value of the experiment. These children of to-day are the adults of to-morrow. Left unrescued in their tenement environment, many would have succumbed to the disease or would have reached maturity as weaklings, their health undermined with tuberculosis and a menace and burden to society, as their parents now are.

Briefly, what can be said regarding the effect of the Home Hospital treatment upon the earning power of the family? Let us take the families discharged in the last year and we see that whereas their average weekly income on admission was \$6.34, on discharge it had increased to \$11.17.

Taking the 39 families still under care at the end of the last year we find that their average weekly incomes have increased from \$3.37 to nearly \$6.

Thus by restoring to health wage earners and other members of dependent families and by teaching each properly to live and to manage a home efficiently the Home Hospital has not only increased the earning powers of those admitted but also has raised the standard of living in each home. The social and economic results during the two years of the experiment strengthen our belief that completely to rehabilitate families either made dependent by tuberculosis, or whose physical breakdown has resulted from destitution, the treatment of the physical and social ills must be combined.

What has the method cost and how does it compare with the usual hospital or sanatorium treatment?

The cost of treatment, including living expenses, cost of medicine, supervision, and administration is indicated by the following figures from the Home Hospital report:

The daily cost per family was \$3.32; per individual, \$0.65; per patient, \$0.66; per nonpatient, \$0.63.

This cost per patient of 66 cents compares very favorably with the average per capita cost of 17 New York State tuberculosis institutions giving individual treatment, the figure for which is \$1.40, or over twice the Home Hospital figure.

To this difference must be added the many unique advantages of the Home Hospital method such as: (1) The directness of its attack upon the home conditions as a crucial, underlying cause of tuberculosis and its consequent poverty; (2) the readiness with which unsuspected, incipient cases may be detected and checked; (3) the exceptional opportunity it affords for adequate control of the disease and family; (4) its avoidance of the opposition, deterrent influence, worry, and other hardships inevitably occasioned by the separation of the sick from the well members of the family; (5) its preservation of the integrity of the home; (6) its care of classes of patients who either could not or would not go to institutions; (7) its fostering an increase of earning capacity in the wage earner and a gradual return to normal conditions; (8) its provision against a return of either the patient or family to the inimical environment where the disease was contracted and is likely to recur; and (9) its care not only for the physical but for the economic and social ills not merely of the patient but of the entire family.

Such a work aims at causes; seeks not only the cure of the individual but the protection of society; is concerned with the patient, his family, and environment, and deals with fundamental questions of livelihood and of life.

SEWAGE DISINFECTION

FOR VESSELS AND RAILWAY COACHES.

By LESLIE C. FRANK, Sanitary Engineer, United States Public Health Service.

The desirability of disinfecting the sewage of vessels traveling in lanes as heavily frequented as those on the Great Lakes system has been emphasized by the studies of De Valin (Reprint No. 168 from the Public Health Reports), and of the International Joint Commission on Boundary Waters. In these lanes of fresh-water travel, within a very short time after one steamer has discharged toilet wastes another steamer will pass over the same spot and may take in drinking water. Furthermore, these lanes of travel pass close by the drinking-water intakes of a number of large cities. The present situation with regard to railways passing over watershed areas is even more serious. The dangers of disease infection due to these conditions need no comment.

In March of this year Prof. Earle B. Phelps suggested that steam might be used to disinfect the sewage from steamers and railway coaches before it is discharged. The following device has been designed by the writer to perform this function automatically.